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Dear Researcher,

Greetings!

Articles in this issue discusses about Performance Analysis of Multilayer Perceptron in Lung Carcinoma Detection with Google, Respiratory and LC Datasets

We look forward many more new technologies in the next month.

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PERFORMANCE ANALYSIS OF MULTILAYER PERCEPTRON IN LUNG CARCINOMA DETECTION WITH GOOGLE, RESPIRATORY AND LC DATASETS

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Abstract - An artificial neural network is a mathematical model that simulates the structure and function of the interconnected neurons in the hidden layer. The neural network makes prediction of training and test set in the input layer which is discussed in the chapter four. ANN has three layers. They are the input, hidden and the output Layers are applied for different datasets. The intermediate layer or hidden layer consists of number of neurons. The input and output consists of the single layer. The intermediate layer is considered as an engine of the whole network which deals with the non linear activation function and sensational domination in the result. The number of neurons determines the quality of the network in all the three layers for google, Respiratory and LC data. LC dataset is applied in the input layer and it provides better result which is sent to the intermediate layer of MLP. The stage of patient's role plays an important play in improving the three layers of MLP. The three layers are input, intermediate and output layer. Each layer classifies the LC stages from input to the output layer. The output layer is the final result of the LC patient. The patient's stage is decided by applying MLP which is executed in WEGA. The MLP is present all the Artificial Neural Network.

Keyword: - Multi Layer Perceptron, Artificial Neural Network, Iterative K Fold Method, Standard Approach, Multi logit regression, Maximum A Posteriori, Hyperbolic cosine loss function.

I. Introduction

Biometrics is human identifications by measuring physical or behavior characteristics of a person to verify his identity. Public safety and national security magnify the need for biometric technique, which are amongst the most secure and accurate authentication tools. Ear images can be acquired in a manner similar to face images, and at least one previous study suggests they are comparable in recognition power. Additional work on ear biometrics may lead to increased recognition flexibility and power in such scenarios.

The ear growth between four months to eight years old is approximately linear, and after that it is constant until around 70 when it increases again. The stretch rate due to gravity is not linear, but it mainly affects the lobe of the ear. Due to its stability and predictable changes, ear recognition is being investigated as potential biometric. Generally, ear images can be acquired in a manner similar to face images, and used in the same scenarios. Therefore, a biometric system can be solved using the methodologies from the pattern recognition research. Researcher considers the use of both 2D and 3D images of the ear, using data.

1. INTRODUCTION

Data mining deals with the patterns that can be mined the information. It consists of two methods namely Descriptive and Classification. Classification method are illustrated by Vidhya et al. [11] is used in the Data Mining which has three phases are

- Data Preprocessing involves Data cleaning, integration, selection and transformation

- Data Extraction handles the occurrence of exact data mining
- Data Evaluation which enables to obtain the final results.

Classification consists of two processes. They involve in calculating the approximate and accurate results.

- Training Phase in classification model has different algorithms, used to build a classifier from test data using the training set from dataset. The model has been trained for the prediction of accurate results.
- Classification Phase is used to predict class labels and testing the built data on test set then calculates approximate results.
- Neural network has a collection of connected units or nodes called neurons which resembles the neurons in a biological brain. These neurons are classified as three layers:
 - i. Input layer collects input patterns
 - ii. Output layer has classifications based on the input.
 - iii. Hidden layers are the result of the input with minimal error.

The three layers have the most important work on the Neural Network and describe the feature extraction accomplishes to statistical techniques in the evaluation analysis.

Lung cancer or Lung carcinoma (LC) is a malignant tumor [9] identified by uncontrolled cell growth in the lung. Lung cancer is a type of cancer starts when cells in the body grow out of control. It start in the windpipe namely as trachea through the airway as bronchus in lung tissue. This growth can penetrate beyond the lung by the process of metastasis into close by tissue or other parts. LC is broadly classified into two types. They are

- Small Cell Lung Carcinoma (SCLC)
- Non-Small Cell lung Carcinoma (NSCLC)

This classification is based upon the microscopic appearance of the tumor cells. These types of cancers grow, increase and are treated in different ways.

Symptoms of lung cancer

There are many symptoms lead to the lung cancer and some of them are listed as follows

- Worsening cough
- Coughing up blood
- Chest pain in breathe

- Dysphonic
- Shortness of breath
- Wheezing
- Weakness and fatigue
- Loss of weight

Small Cell Lung Cancer

Small cell lung cancer is also known as "oat-cell" cancer because the cells look like oats under the microscope. SCLC is preventing 10% to 15% of lung cancers patients which is termed as stage I. It starts in the bronchi, then grows and spreads to other parts of the body in lymph nodes. This type of lung cancer is aggressive and rapidly growing to NSCLC. SCLC is strongly caused by tobacco smoking. SCLC found in trachea and spread widely.

Non-small cell lung cancer

Non-small cell lung cancer affects 80% to 85% of patients. It grows at a slower rate than SCLC. NSCLC conditions is termed stage II, stage III and stage IV and its types are

- **Adenocarcinoma (AC)** is found in the outer region of the lung represent in stage II.
- **Squamous Cell Carcinoma (SCC)** arise in the middle chest area is the bronchi of the lungs represents stage III.
- **Large Cell Carcinoma (LCC)** begin anywhere in the lungs and grows fast to stage IV.

These symptoms affect the lungs can be described by Senthil *et. al.* [10] in two types that represent the four stages of the disease for the patients. Staging lung cancer is based on local or spread from the lungs to the lymph nodes. Tumors can grow for a long time in the large lungs done by stages.

Preprocessing

Preprocessing includes several techniques like cleaning, integration, transformation and reduction. The product of data preprocessing is the final training set. The outcomes of the final data processing can be interpreted the results in the multiclass processing of data. The preprocessing method applies for LC dataset which reduce the insignificant number of attributes by machine learning method is exposed in

- Data cleaning have many irrelevant and missing parts to handle data cleaning of missing data, noisy data etc.
- Missing Data arises when missing some data are handled in ignorance of the tuples and fill the missing values.

- Noisy data is empty data that cannot be interpreted by machines and generated due to faulty data collection or errors entry data.

Gain method takes the chosen attributes for the dataset. It corrects the Information Gain (IG) by taking the intrinsic information are explained by Karthigai *et al.* [6]. Disregarded class designed by the intrinsic information and the value is calculated by the entropy of the distribution before the split and minimize the entropy after the split.

2. Literature Review

Andrew *et al.* [1] described DNA-microarray and sequencing technology to simultaneously measure the expression levels of thousands of genes, resulting in large amounts of potentially intriguing data, which requires careful, insightful, and robust analysis. ANN analysis strategies capable of addressing many noisy, correlated inputs, their parallel nature for the simultaneous detection of a multitude of subtle, pertinent features, thus allowing researchers to gain valuable knowledge regarding the cause, progression, and treatment of cancer. Their reputations as accurate classifiers, robust predictors, and versatile approximation tools have remained strong and enhanced by the ingenuity of a multitude currently developed methodologies to their domain of inquiry, designing novel and powerful implementations.

An experimental comparison of Artificial Neural Network and support vector machine (SVM) ensembles and their “nonensemble” variants for lung cancer prediction is reported by Emmanuel *et al* [2]. These machine learning classifiers were trained to predict lung cancer using samples of patient nucleotides with mutations in the epidermal growth factor receptor, Kirsten rat sarcoma viral oncogene, and tumor suppressor p53 genomes collected as biomarkers from the IGDB, NSCLC corpus. The Voss DNA encoding was used to map the nucleotide sequences of mutated and normal genomes to obtain the equivalent numerical genomic sequences for training the selected classifiers. The histogram of oriented gradient (HOG) and local binary pattern (LBP) state-of-the-art feature extraction schemes were applied to extract representative genomic features from the encoded sequences of nucleotides. The ANN ensemble and HOG best fit the training dataset with accuracy for automated screening and early stage lung cancer patients in risk populations.

Gurpreet *et al* [3] the early detection of cancer can be helpful in curing the disease completely and to detect the occurrence of cancer nodule in early stage. A disease that is commonly misdiagnosed is lung cancer. Neural Networks participates a vital role in the medical field in solving various health problems like acute diseases and even other mild diseases. Earlier diagnosis of Lung Cancer saves enormous lives, failing which may lead to other severe problems causing sudden fatal end. Its cure rate and prognosis depends mainly on the early detection and diagnosis of the disease and provides a Neural Network and SVM model for early detection of lung cancer. The model consists of an input layer, a hidden layer and an output layer. The network is trained with one hidden layer and one output layer by giving twelve inputs. One of the most common forms of medical malpractices globally is an error in diagnosis. The Neural Network and SVM have been implemented using two steps training and testing phases.

Richa *et al* [9] observed that Neural Networks are the manipulated form of human brain nervous system is highly inspired by the brain nervous system. The survey paper demonstrates different kind of neural network models and architecture of activation functions applications in various fields of recognition. The neural network models in biologically realistic neuron model discussed like spiking neuron model. The comparative study of models in the field like recognition and pattern classification is discussed.

Yen-Chen *et al.* [12] illustrated Adjuvant chemotherapy (ACT) used after surgery to prevent recurrence or metastases. ACT for non-small cell lung cancer to develop prediction models and to identify the ACT correlated gene and performed several types of ANN algorithms. The results obtained 2 genes with T-stage clinical data combination can get good prediction result and 10-fold cross validation classification accuracy.

The overall proposed methods bring to the specific types of cancer stage. This is influenced by the external factors and introduces the patient stages. This method is helpful to reduce the time of medical treatment. It also gives the possible service of MLP to identify the specific stage. These stages can identify the patient survival time and helpful for the treatment.

3. Methodology

MLP is having more than one perceptron which is called multilayer perceptron illustrated by Meenakshisundaram *et. al.* [8] is located in Artificial Neural Networks (ANN). They consist of input layer, hidden layer and output layer. The input layer receives the signal, the output layer collects the signal from the input layer and gives the result. The middle layer fixes the neurons after calculating the weights and forwarded to the output layer.

A. Existing Method

Multi Layer Perceptron has nonlinear separate function. The MLP comprises of three or more layers with nonlinear activating nodes. Since they are fully connected, each node in one layer is connected to every node in the following layer with a weight. Logistic Sigmoid method is used in the activation function maps. The result of these values in between 0 and 1 called a transfer function. It makes the model to adapt with variant of data and distinguish between the outputs in binary manner. It is a mathematical function and has a characteristic of 'S' shaped curve. It is classified as bounded, differentiable and real function from the input values which has a non negative derivative at each point. Using sigmoid the outcome is predicted as a probability since it ranges between 0 and 1.

Disadvantages

- Logistic Sigmoid function cannot handle multi class classification.
- Lack of error occurred by calculating Euclidian norm.

To overcome the disadvantages of the existing method the proposed method is implemented to handle the multiclass classification.

B. Proposed Method

MLP is the mathematical solution from the input to output for a non-linear method. Backpropagation is used by the gradient descent optimization to adjust the weight of neurons with the calculation of the loss gradient function or backward propagation of errors. Gradient descent is a process in the backpropagation to continue the gradient training parameter in the opposite direction based on the updating weight and minimizing the error in the training set. It is used in the training of neural network for supervised learning on the training set.

The proposed LC dataset discussed in chapter three has improved the performance of machine learning algorithm in classification technique comes under data mining. Iterative K-Fold Cross Validation is applied in the input Layer are described by Karthigai *et. al.* [5] The works splitting the dataset into three are known as K parts. Each part is called a fold. Then the algorithm is trained for k-1 folds with two third portions for the training data and tested the remaining portion for three times.

The intermediate layer provides the intermediate layer for finding the average of attributes and class neurons from other three approaches are described by Meenakshisundaram *et. al.* [7]. Activation function is used for the input neurons because transmits the input dataset directly to the next layer. Gradient descent is applied to update the parameters of the LC dataset. The input dataset is selected from the LC dataset. IKFM is applied on the input for enhancement to eliminate the bias, variance and overfitting problem that are presents in the dataset. In order to enhance the clarity of the detecting stages in LC fixation of hidden neurons is applied in the intermediate layer and finally obtained the better way.

Gradient is also an iterative optimization algorithm was explained by Karthigai *et. al.* [4] for finding the minimum of function. The algorithm takes step propagation to the negative gradient of the function at the training set to obtain the minimum error. Gradient descent has two types are stochastic and mini batch gradient descent. Stochastic gradient descent is applied in a training set is which is passed through the neural network at a time and the weights of each layer are updated with the calculating gradient. At one time a single training set is passed through the neural network and its loss function is also calculated. The weight of all the layers of the neural network is updated after the training set. The test set is multiplied by the derivation of the function by the minimum loss function. The Mini Batch Gradient Descent (MBGD) is applied in the MLP output layer. A mini batch size is taken to the power of two and fits the memory requirements as 32, 64, 128, and 256 and so on.

They involve in two steps are

- Compute gradient function on training set.
- Move in the opposite direction from the output layer to the input layer by the training set.

Multi Logit and Hyperbolic Cosin Method are applied in the mini batch of the output layer. It is

calculated to predict the highest value of the training set and the test set. Both the methods used in the mini batch gradient descent way for calculating the highest prediction in the training and test set. The main concept is to calculate average training samples create the gradient errors reporting.

Advantages

- MAP estimates the training set of the posterior distribution of observations.
- Calculate the error in the test set estimate the value for prediction.
- The logistic model is estimated to predict the highest value in training set.
- To solve overfitting problem by Maximum likelihood function.

Procedure

Input: Initialize output of the hidden layer to the output Layer

Output: Classify the class by four levels of the patients in MLHCM

Step 1: Input is trained in IKFM through the weights are selected by fixing the neurons in the intermediate layer.

Step 2: Calculates the output for every neuron from the input layer to the hidden layer to the output.

Step 3: Handles mini batch gradient descent for calculating the error in the output layer.

Step 4: Apply multi logit function to predict the value in the training set.

Step 5: Calculate the logistic function for classifying the multi class.

Step 6: Compute Maximum A Posteriori estimates the posterior distribution of observations.

Step 7: Calculate the Hyperbolic Cosin Method is to measure the predict value of the test set.

Step 8: Travel back from the output layer to the intermediate layer to adjust the weight.

Step 9: If the error is decreased repeating the process right from step 3 until the desired output is received to minimize the error.

The error is calculated in the output and propagated in the backward direction through the layers. The error is calculated by the Mini Batch Gradient Desent.

Google Dataset

Google Lung Cancer Dataset decides the Survival of patients who are in advanced stages of lung cancer. The optimal discriminate plane for a small number of samples and design method of

classifier on the plane. The Google dataset helps to apply 25 attributes for 1000 patient.

Respiratory Dataset

The data are from a clinical trial of patients with respiratory illness from 111 patients with 7 attributes which are collects from two different clinics were randomized to receive either placebo or an active treatment. Patients were examined at baseline at four visits during treatment.

Lung Cancer Dataset

The LC dataset in excel sheet consists of sixteen attributes are Patient id, gender, chronic cough, Hemoptysis, Pain, Dysponia, Cachexia, Infection, Wheezing, Swelling, Dyspnea, Clubbing nails, Dysphasia, Tumour location, pneumonia, fatigue. Class is derived from the sixteen attributes and four trials in a class and they are Adeno carcinoma, Squamous carcinoma, Large cell Lung Carcinoma (LSLC) and Small Cell Lung Carcinoma (SCLC).

The four dataset are compared with the existing method Decision tree neural network and the enhanced three layers of artificial neural network.

4. Result and Discussion

Multi logic and hyperbolic cosin method is used in the output layer which is known as final layer as shown in table 4.1. The result of the intermediate layer is passed onto the output layer so that the accuracy is improved. Mini batch gradient descent is used in backpropagation or gradient descent. It is used to minimize the error in the test set. It handles two concepts which are hyperbolic cosin function and multi logit regression function. These methods bring the final result of the MLP in ANN. The classification class describes the stages of the patients. The correctly classified instances represent through the cross shapes.

The result gives that MLHCM is better than ADALINE with nine measures and all the parameters can be calculated by confusion matrix, as follows

- True positive rate is measured by the deciding factor cross. The outcome result is 96%.
- False positive rate is considered as the number of incorrect positive predictions divided by the total number of negatives in the LC dataset and 0.02% is predicted as negative, by using the equation 3.6. To get better result false positive must be low.

Table 4.1 Parameter Evaluations of Output layer for Different Datasets

Evaluation measures	Google Dataset	Respiratory Dataset	LC Dataset
TP Rate	0.933	0.892	0.956
FP Rate	0.05	0.07	0.017
Precision	0.935	0.894	0.958
Recall	0.933	0.892	0.956
F-Measure	0.932	0.891	0.955
MCC	0.918	0.877	0.941
ROC	0.975	0.934	0.998
PRC	0.971	0.93	0.994
Accuracy	0.933	0.892	0.956

- The FM1 result 96% is calculated by the average methods for the precision and the recall.
- MCC deals into the relations of true and false positives and negatives for balanced measure and used in different sizes and 94% is the predicted.

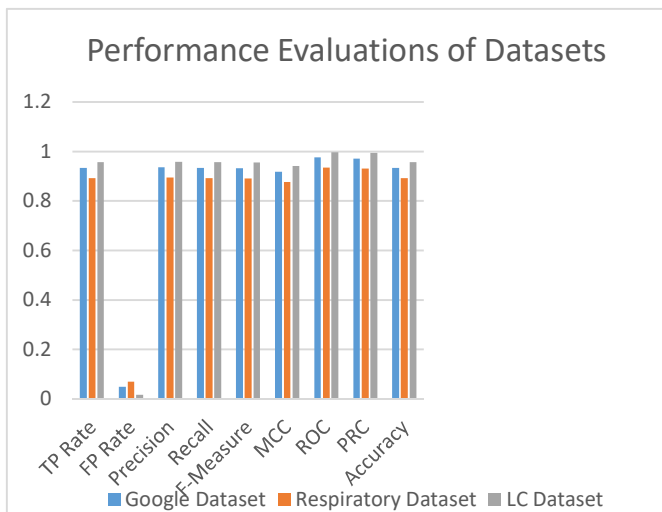


Fig.4.1 Performance Evaluations of MLHCM in Output Layer for Different Chart

- Precision is conformed basing on the positive rate for 96% of predictions.
- Recall can be defined as the total number of correctly classified positive instances whose percentage is 96.
- Accuracy plays an important role in the confusion matrix. It calculates the correct predictions and generates 96% as shown in the figure 4.1.

The visualization of the evaluation parameters in the different datasets can be adapted in the WEKA.

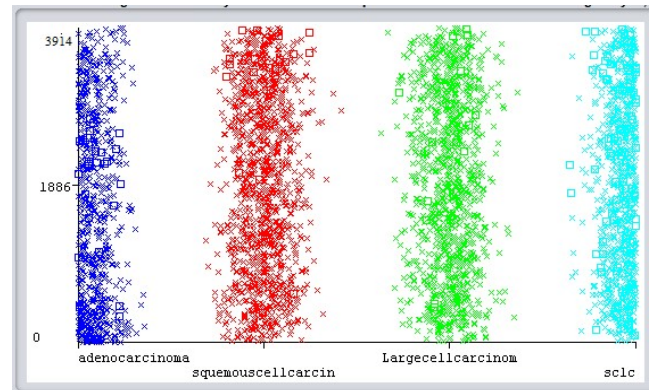


Fig.4.2 Classification chart of the output layer

Nine parameters of performance Evaluation can be calculated by confusion matrix and accuracy can be calculated by correctly classified instances then error can be defined as incorrectly classified instances.

The correctly classified instances are taken into the account for the accuracy. The incorrectly classified instances expose the false positive rate which is illustrated in the figure 4.2. This result is compared with the ADALINE method based on the Artificial Neural Network.

5. Conclusion and Feature Work

The overall results of the proposed methods are clearly executed in three layers of MLP based on the NN for all the datasets. The LC datasets gives the better result in the MLP improving the input layer to the output layers. The different datasets are compared with the existing and proposed method of each layer. The result of output layer is proved as the better method and it is compared with the existing method ADALINE. The improved MLP gives the better accurate result which comes as 96%, based on the Artificial Neural Network. From the confusion matrix the stages of the patients are clearly defined. Finally, the result of the proposed method classifies the stages of the patients.

- 704 patients are under adeno carcinoma which is classified as stage II.
- 1199 patients are suffering from squamous, it is known as stage III.
- It is found that 1093 LC patients come under large cell are in stage IV.

- It is felt that 744 LC patients come under SCLC are in stage I.

Finally it is learnt that the output layer gives the better accuracy by enhancing the three layers of MLP in classifying the patient stages. This result of the research may be useful for the physicians, who are toiling for the cure of the lung cancer patients. The future work can be resolved the classification issue and to enhance the performance of the classification of the stages. The future extension of the Lung cancer dataset can be executed to improve the accuracy on fuzzy logic method.

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A young boy with dark hair is leaning against the fuselage of a white glider. He is wearing a teal long-sleeved t-shirt with a dinosaur graphic, camouflage-patterned pants, and red sneakers. The glider has a red stripe along its side. The background consists of a wooded area with trees and a small building in the distance.

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